



NASA SBIR/STTR Technologies

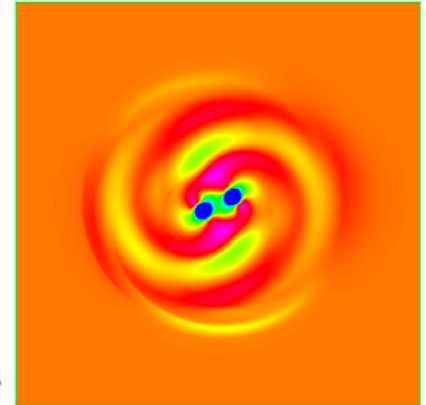
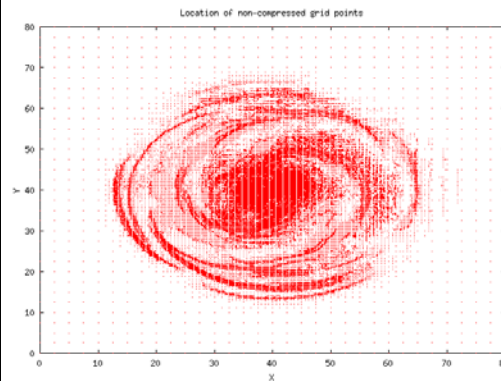
High Order Wavelet-Based Multiresolution Technology For Airframe Noise Prediction

PI: Dr. Essam Sheta/ CFD Research Corporation, Huntsville, AL
Proposal No.: A2.04-8581



Description and Objectives

- Develop an integrated framework for prediction of noise and vibration-induced noise of rotorcraft and airframes.
- The framework will include high order wavelet multiresolution CFD module with Chimera/overset grid capabilities, a Ffowcs William Hawking acoustic analogy, a Detached Eddy Simulation (DES) module, and finite element structure dynamics module.
- The proposed technology will provide two to three orders-of-magnitude reduction in CPU requirements over existing techniques.
- The multiresolution technology is applicable to a wide range of applications that involve embedded flow features requiring high resolutions, such as Turbo-machinery, Cavitation, Biomedical, Electronic Cooling.



Multiresolution high-order simulation of 2D noise source and acoustic waves propagation and the associated multiresolution grid points.

Approach

- Development of an adaptive multiresolution wavelet compression high-order algorithm for rotorcraft and airframes noise prediction.
- Development of Kirchhoff-Ffowcs Williams and Hawking acoustic analogy module.
- In phase I, the feasibility of the method will be demonstrated by predicting the noise source and acoustic waves propagation of three-dimensional problems involving vortex-blade interaction.
- In Phase II, an efficient data structure for data storage and compression will be developed, a turbulence model using detached eddy simulation will be developed. The modules will be integrated together with finite element structure dynamics module.

Subcontractors/Partners

Professor Kader Frendi of Department of Mechanical and Aerospace Engineering, University of Alabama in Huntsville.

Schedule and Deliverables

- The Phase I effort is to be completed in 6 months.
- The developed framework will be delivered and installed at NASA facilities.
- Demonstration and hand-on training sessions will be provided.
- Monthly progress reports, final report and future R&D recommendations will be delivered.

NASA & Commercial Applications

- The environment is expected to be used extensively by NASA, Army, Air Force, and aerospace contractors directly for prediction of noise and vibration-induced noise of rotorcraft and airframes.
- Other application include flutter and buffet analysis of helicopter and fighters, analysis of active twist rotors and nonlinear lift systems.